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8. *Logic and Scientific Methods.*—Of course, the status of scientific method has always had reflex influence upon logic; but in the main this has taken effect in the past through the efforts of those who were already logicians in utilizing the methods of experimental science in connection with the building up of their own systems. Without ignoring the tremendous fluctuation that has come to logic from such endeavors, we may expect, I think, still more fertilization when scientific men undertake an independent statement of the logical bearings of their own modes of procedure. We clearly are entering upon this stage of development. It is necessary only to refer to such names as Poincaré, Boltzmann and Mach.

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THE NECESSITY FROM THE STANDPOINT OF SCIENTIFIC METHOD OF A RECONSTRUCTION OF THE IDEAS OF THE PSYCHICAL AND THE PHYSICAL

SCIENCE is the attempt to give a rational explanation of the universe. Its earliest systematic statement is that of the so-called physical sciences—astronomy, physics, chemistry—in which the world is interpreted in purely mechanical terms. Nature is a mechanism. The concepts with which science operates in this stage are matter and motion. The material units, atoms, which make up the universe, are in constant movement. There is an extended substance, and this substance is in process of universal change. Ultimately, reality consists simply of atoms and their movements. There may be all sorts of combinations of these atoms; they may stand in all sorts of relations by reason of their ceaseless change; but ultimately there is conceived to be a substance, called matter, lying back of the changes. Matter is the permanent core of reality which runs through the changes, which underlies the movements of the atoms and makes them possible. This is the philosophical postulate of the earliest scientific physics—the existence of matter in motion. Inasmuch as matter is made fundamental in the conception, and this matter is conceived as given in little bits or units called atoms, this may be called the static conception of the universe, the lump theory of reality. The view has been held by mechanical scientists and philosophers from the time of Democritus. And it must be said that great fundamental principles have been established from this standpoint, which more recent science has restated rather than overthrown.

But, with the progress of scientific inquiry, especially with the advance of experimental investigation, the fact of change, of motion, has become more and more prominent, while the conception of an abiding substance postulated as underlying the changes has receded from view. The existence of matter has not been disproved, but its utility as a concept in its old static form has vanished in the light of a new understanding of the nature of motion. In place of dead inert matter have been put the positive conceptions of energy and force. Motion was formerly regarded simply as the phenomenal manifestation of some real entity—matter—lying behind, or it was conceived as a force operating upon matter from without. Under the name of energy, motion is now regarded as itself the essence of reality, and the idea of brute, lump matter drops away. In place of the static we get a dynamic theory of the nature of reality. *Substance c'est l'action.* What was formerly called the material object or thing is now regarded as simply the latent or potential as contrasted with the active or kinetic form of energy. Instead of speaking of the indestructibility and homogeneity of matter, science now speaks of the permanence of force and the interconvertibility of energy. An atom is a center of motions, a vortex ring, the focus of a system of forces, an equilibrium of opposing energies. This is the dynamic or energistic view quite generally held by philosophical physicists to-day.

But while this dynamic view is transforming physics, another group of sciences—the biological—is coming into prominence. Biology existed alongside of physics, of course, from the first. But the nineteenth century is the epoch of the great development of the sciences of life. The statements of physics and chemistry are not the whole story. Nature is not only a mechanism. It is an organism. The biological categories do not negate those of physical science. On the other hand, the tendency of biological science has been steadily opposed to vitalism with its doctrine of occult force. It makes the fullest use of chemical and physical laws in explaining organic phenomena. At the same time, it recognizes that the organism is not a mere machine, as that term is customarily used; it is a living machine.

Here, again, we see progress from a static to a dynamic conception of life. Early biology was content with a doctrine of special creation, of fixed species, of a special vital force. Morphology in the modern sense was unknown. But with the rise of the genetic and comparative methods in science, biology has come to see the essential unity and continuity of all organic processes. The concepts of heredity and transmission, of variability and selection, of development and evolution, emphasize the idea of growth, as physical science has emphasized the idea of ceaseless change or motion. And here, as before, scientific thought does not rest until it generalizes the idea. Evolution becomes a universal law of nature. The universe is a vital, living whole. It is organic. There is a cosmic life and a cosmic evolution; the principle of continuity requires it.

At first the conception of growth was restricted to a certain sphere called the organic realm. But investigation showed that the vital is built upon the basis of the mineral world, that the organic actually assimilates and incorporates the inorganic, building it into its tissues. The difference between the inorganic and the organic seems to reduce simply to a difference in organization. The difference is not a difference in kind, but only in degree or complexity of organization. This is shown, indeed, by the fact that the biologist falls back upon the chemicophysical laws for the explanation of vital processes. From this point of view, therefore, the universe may rightly be called an organism, without departing from the biological definition of an organism as a self-perpetuating system or mechanism in which the constituent parts are related reciprocally as means and ends. The evidence tends increasingly to show that the universe is an organic, and not merely a mechanical, whole. If the chemicophysical categories are to be carried up throughout the world of life, the biological categories must be carried back to the interpretation of the world of matter and motion. Either the chemicophyscial laws do not hold in the biological sphere—in which case there is a distinct vital force, and this contradicts the law of the conservation of energy—or they do hold in the biological sphere, in which case the idea of mechanism must be extended to cover the phenomena exhibited by organic life. And if the organic differs from the inorganic simply in degree of organization, then, on the same principle, it is not only legitimate, but distinctly illuminating, to carry back the biological categories to correct the inevitable abstractions made in the physical sciences.

This sufficiently meets the arguments of those who, like Professor Ostwald, would subordinate psychical phenomena to the idea of energy. The bare concept of energy, even when interpreted from the modern standpoint of dynamism in physics, is too poor to express the contents of the ideas of life and mind. Unquestionably, these latter concepts, as they are at present used, will have to be modified before they will form a continuous series with the concept of energy. The only point here urged is that the modification can not be all on the side of the biological and psychological categories. The concepts of biology and psychology must reconstitute the concepts of physical science as truly as the converse. Indeed, is not the modern concept of energy itself a good illustration of the idealization of a material category, of the spiritualization of matter? Psychical phenomena are not to be 'subordinated' (the term is Professor Ostwald's) to the concept of energy, but both concepts are to be reconstituted, each in terms of the other. Viewed in this light, one may even accept the words of the writer just mentioned, when he says: 'In all that we know of intellectual processes, there is nothing to hinder us from regarding them as a particular form of energetic activity.'[1] Indeed, this is just the present tendency of a certain school of psychology—to interpret all psychical phenomena functionally, *i. e.*, in terms of action, activity, energy, if you please.

As has just been intimated, another step remains to be taken beyond the physical and the biological standpoints. Besides the physical and the biological there are the psychological sciences. Besides matter and motion, besides the organism and life, there is consciousness and personality. The twentieth century bids fair to be the epoch of scientific psychology. The greatest theoretical problem of the science of the present day is as to what it is going to do with consciousness. On the one side, science is inclined to regard consciousness as simply one phase, and that a comparatively recent phase, of evolution. But is consciousness, in this case, to be interpreted solely in terms of the physicochemical, or even in terms of the biological, categories? If so, then these categories will have to be so revised as to do justice to the new facts.

On the other side, scientists, as well as metaphysicians, have not been slow to see that there is a sense in which the very existence of the external world, and the science of this world, are conditioned upon consciousness. An object, or a universe, that appears to no one, that is not present to some consciousness, that is not an object of knowledge by some intelligent being, would seem to be simply nonexistent. There appears to be a sense in which the system of the universe has been built up in the scientific consciousness of the race, analogous to the way in which the world of space and time is built up in the consciousness of the child. From this point of view consciousness seems to condition the very possibility of science. How, then, can consciousness be simply a relatively late product of biological evolution? If time (including the historical development of science) has been built up in consciousness, how can consciousness be an evolution in time?

The solution of this apparent paradox lies in seeing that consciousness, taken apart from the organism which is conscious, is not an entity or thing or even a process; it is simply meaning or significance. Consciousness, taken in abstraction from body, is like what you get when you attempt to conceive function abstractly, apart from the organ or structure which functions. Function, thus conceived, signifies no more than a sum of relations or meanings.[2] The enigma reduces, therefore, to a mere verbal fallacy. After abstracting the psychical, by definition, from the physical, there still cling to our psychological statements of the nature of consciousness traces of our conceptions of material objects. There is no actual consciousness apart from an organism. But in our thinking and speaking concerning consciousness we split apart these two aspects of the psychical and the physical for purposes of discussion. They are one, but in the very act of saying it we make them two. Any thinking or speaking is a polarizing into two aspects in thought of what is an undivided unity for action. This, of course, is a methodological, not an ontological dualism; hence is paradoxical only for him who forgets its methodological origin.

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[1] Ostwald, 'The Philosophical Meaning of Energy,' *International Quarterly*, VII., No. 2, June, 1903, p. 313.

Psychology illustrates this split in scientific thinking. And psychology too often fails to remember that its abstractions are simply methodological devices or instruments and not an actual duality of existences. If this important point is kept in mind, the paradox of psychophysical parallelism disappears, and this apparent contradiction between time and consciousness is cleared up. Consciousness is in time, of course, when consciousness is regarded as it actually exists, as functioning of the nervous system. Time is in consciousness just as truly, however, when consciousness is regarded as the bare significance or meaning, in abstraction from its existential or physical basis, the body; for time, from this standpoint, is just one meaning among others. The solution of the antinomies which arise in the conflict of the different sciences is to be found in interpreting them always in terms of the methodological abstractions with which these sciences operate.

Here, then, as in the previous cases, the truth lies in generalizing, in universalizing, the laws of the new science. The conception of consciousness must be extended to the entire universe. The universe is a mechanism. It is an organism. The universe is also a conscious personality. Whether or not this is to become mere metaphysical verbiage will depend upon one's conception of consciousness and of personality.[3] Certain it is that this is the only escape from the blind alley into which modern science has brought us in its doctrine of psychophysical parallelism, which insists at once that consciousness is the universal accompaniment of the material body, yet has absolutely nothing to do with the continued existence of that body. This absurdity can only be escaped by revising our conceptions of consciousness and the self. Consciousness is not a thing, an entity, a force, any more than the function of an organ is a part of its structure. The function of an organ is the activity of that organ, its orderly and continuous operation with reference to an end or norm. Consciousness, or the psychical, in the same sense, is the functioning of the material or physical universe. Consciousness is not an entity, a thing; it is a function, a meaning. There is no more reason for making an entity out of consciousness than out of habit. We no longer speak of mind *and* its faculties, of functions and that which *has* the functions. The mind does not *have* functions; it *is* the functions. It is real only in its activity, or rather, its activity, its functioning, is its reality. Its various 'faculties'—sense-perception, memory, imagination, etc.—do not 'belong to' the mind; they *are* the mind. Each factor is the function of a common activity, a moment in the single process.

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[2] Cf. Bawden, 'The Functional Theory of Parallelism,' *Philos. Rev.*, May, 1903, 299–301, on this point.

[3] See a forthcoming article in the *Philosophical Review* on the 'Meaning of the Psychical from the Standpoint of the Functional Psychology.'

Now just as an organ may be relatively at rest or in active operation, so the universe, or any portion of it, such as the organism itself, may be in a relatively stable or in a relatively tensional state. An experience is psychical in so far as it is being made focal. Any experience is psychical in so far as it is treated as having been modified, as being modified, or as capable of being modified, in consciousness. That is, its psychical quality depends upon its relation to the process of tension or reconstruction. And the only sense in which there is any meaning in the concept of ' unconscious mental states ' is that certain phases of experience are what they are because of their having been or their capacity for being thus mediated. Consciousness is not something which belongs exclusively to you or to me. It is simply our name for tension, for variation, for progress, of the whole system of reality. This is the general principle. Whether and how consciousness appears in any given focus of forces in tension is an empirical problem upon which physiological and comparative psychology are beginning to throw some light.

When tensional, reality bifurcates or polarizes into the psychical and the physical; this tension, this polarity, is consciousness. When reality is in relative stability or equilibrium, this distinction does not emerge; this is the relative unconsciousness of primary and secondary automatism. Consciousness is thus generalized for the whole of nature, and the physicochemical and the biological are in turn sublated by the psychological categories. From this point of view we may even agree with Mr. Maudsley when he says that 'in the order of nature mind is not something detached, proceeding not from it, independent of its laws; . . . it is itself nature in process of becoming' ('Problems of Life and Mind,' p. 205).

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DISCUSSION

ORGANIC IMAGES

I AM glad to find myself in accord with most of what Professor Titchener says, especially as to the uselessness of the results gained by the questionary in the matter of organic images, and as to the need of more careful and systematic investigation in this subject. To his disbelief in the genuineness of the organic images of the 80 or 89 per cent. of the students examined by French, I can add my own in the results of Ribot,[1] who says that almost all of his 100 subjects recalled fatigue, sometimes almost to hallucination, and the same for nausea; and 75 recalled thirst and 45 hunger.

My own conviction is that organic images are as conceivable as any other kind, have been experienced by myself, and *may,* presumably, be experienced by others; that the visual or auditory are no more *necessary* than the organic, because there have been scientific men and members of the British Royal Academy who have had no mental images at all.[2] The problem as to the kinds and amounts of organic images revivable does not, indeed, seem to me to be different from that of any other kinds of images, even visual or auditory. I believe that all images, of whatever kind, are the emergence into consciousness of some disposition. This disposition in turn is the result or effect of impressions that have or have not been in consciousness at the time they were received. I do not know any adequate cause for their appearance in consciousness. I see no reason why, if the attention be turned to it, the image of any previously experienced sensation should not form some subsequent state of consciousness. To me the real problem is, what *is* the organic image?

It has seemed to me that the criterion of an image of any kind not organic is a feeling which I can not at present differentiate from a faint organic sensation—the organic sensation accompanying general bodily activity, such as pushing or tugging, of which feeling

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[1] 'Recherche sur la memoire affective,' *Revue Philosophique,* October, 1894, and 'La Psychologie des Sentiments,' Ch. XI., § 2.

[2] Galton, 'Inquiries into Human Faculty.' Also compare James, 'Psychology,' II., 53, who says that he is a good draughtsman but an extremely poor visualizer.